b^* Measurement at D0

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Luminosity Meeting

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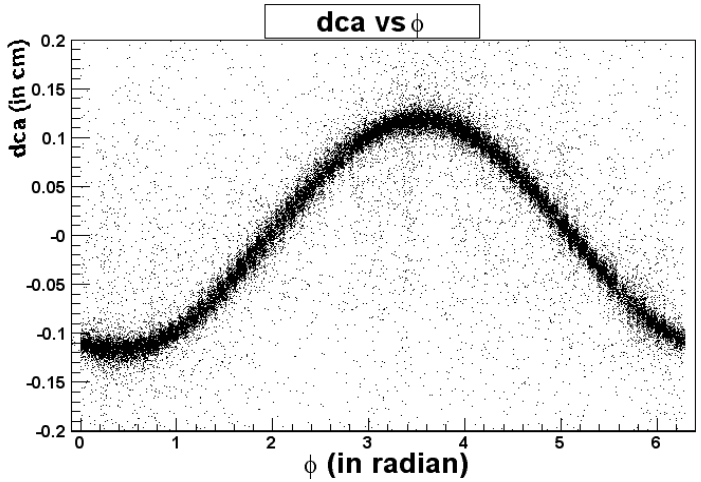
The Method

- Interaction region is from -40cm to +40cm on z-axis, dividing data in slices of 5 cm each on z-axis, total 16 division (say z-region)
- For each z-region, dca vs ϕ plot is of sinusoidal shape because of

$$dca = y_v \cos\phi - x_v \sin\phi$$



$$\langle d_1 d_2 \rangle = \tfrac{1}{2}(\sigma_2^2 - \sigma_1^2)\cos 2\Phi + \tfrac{1}{2}(\sigma_2^2 + \sigma_1^2)\cos\Delta\Phi - T\sin 2\Phi$$

where, σ_1, σ_2 and T are parameters

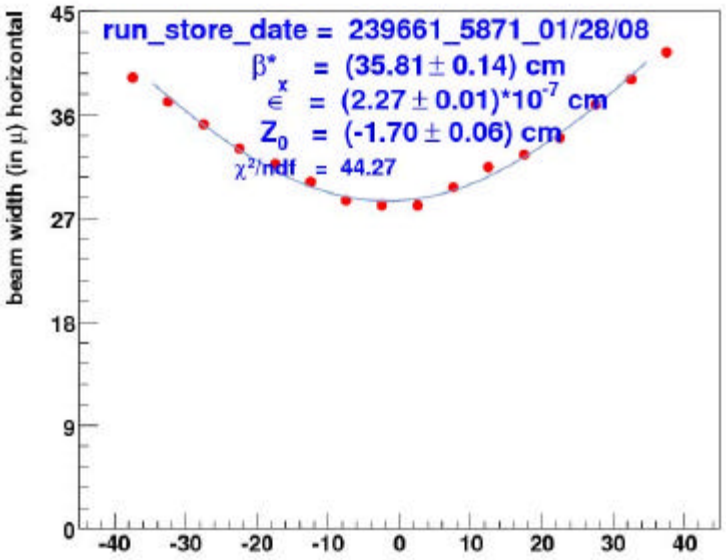
- x_v & y_v → (x, y) coordinate of the vertex
- d_1 & d_2 → impact parameter of two tracks from the same vertex
- σ_1 & σ_2 → beam width in horizontal and vertical plane
- T → correlation between σ_1 & σ_2

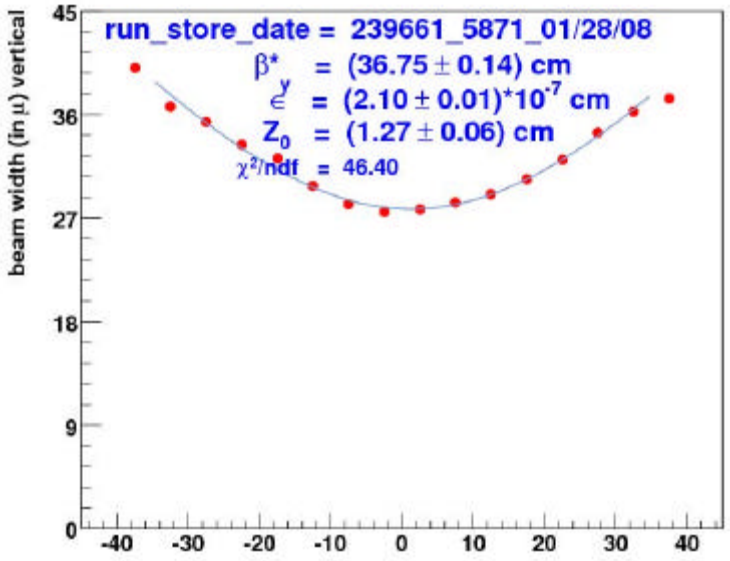
The interaction region is a drift in the Tevatron, z dependence of beam width given by following formula

$$s^2 = e_{eff}\left[b^* + \frac{(z - z_0)^2}{b^*}\right]$$

$s_i \rightarrow b^*_i$

Red dots corresponds to beam width (in micron m)

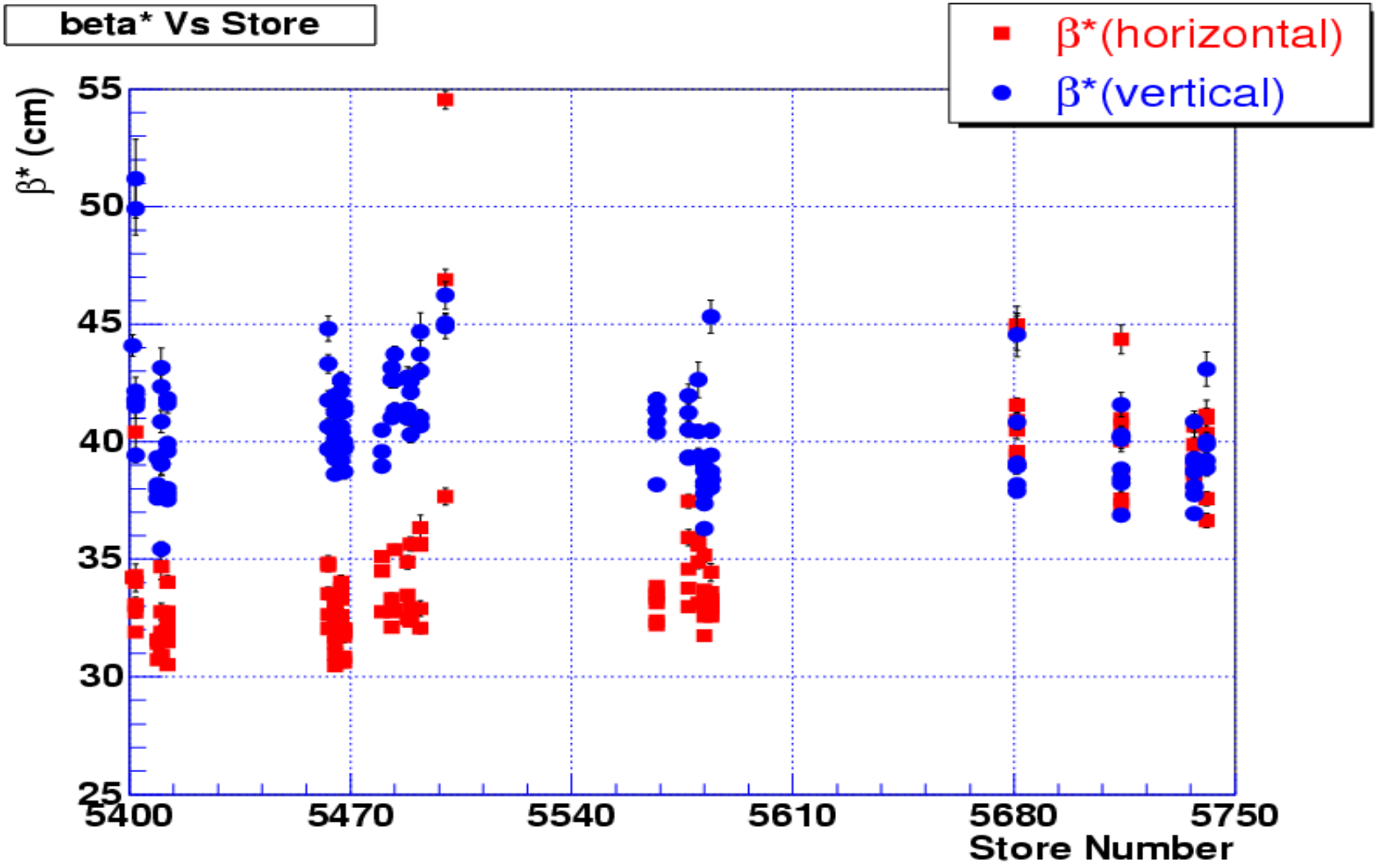




Z-axis (cm)

$$s^2 = e_{eff}\left[b^* + \frac{(z - z_0)^2}{b^*}\right]$$

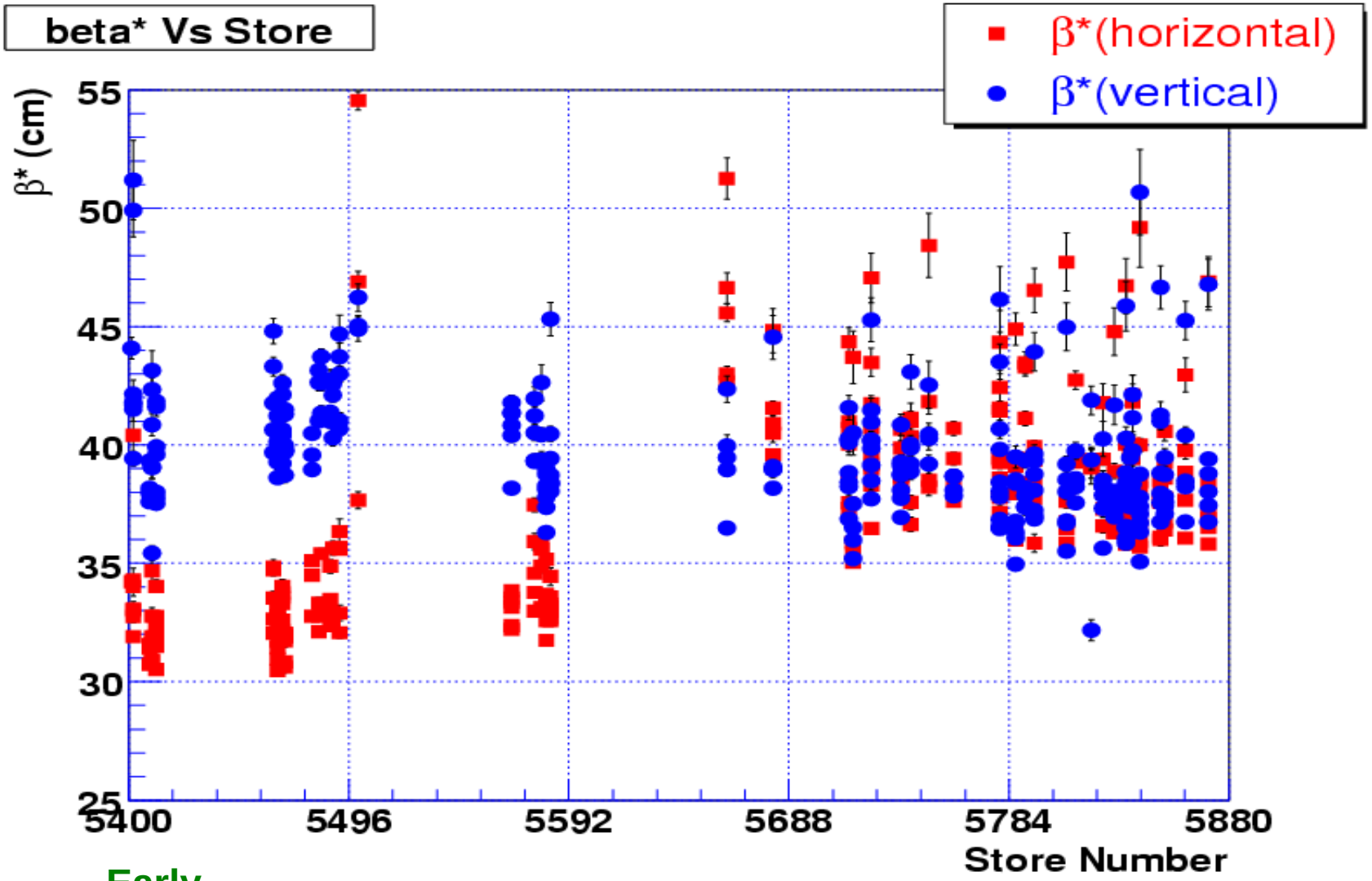
from last meeting



Early
May'07

End
Nov'07

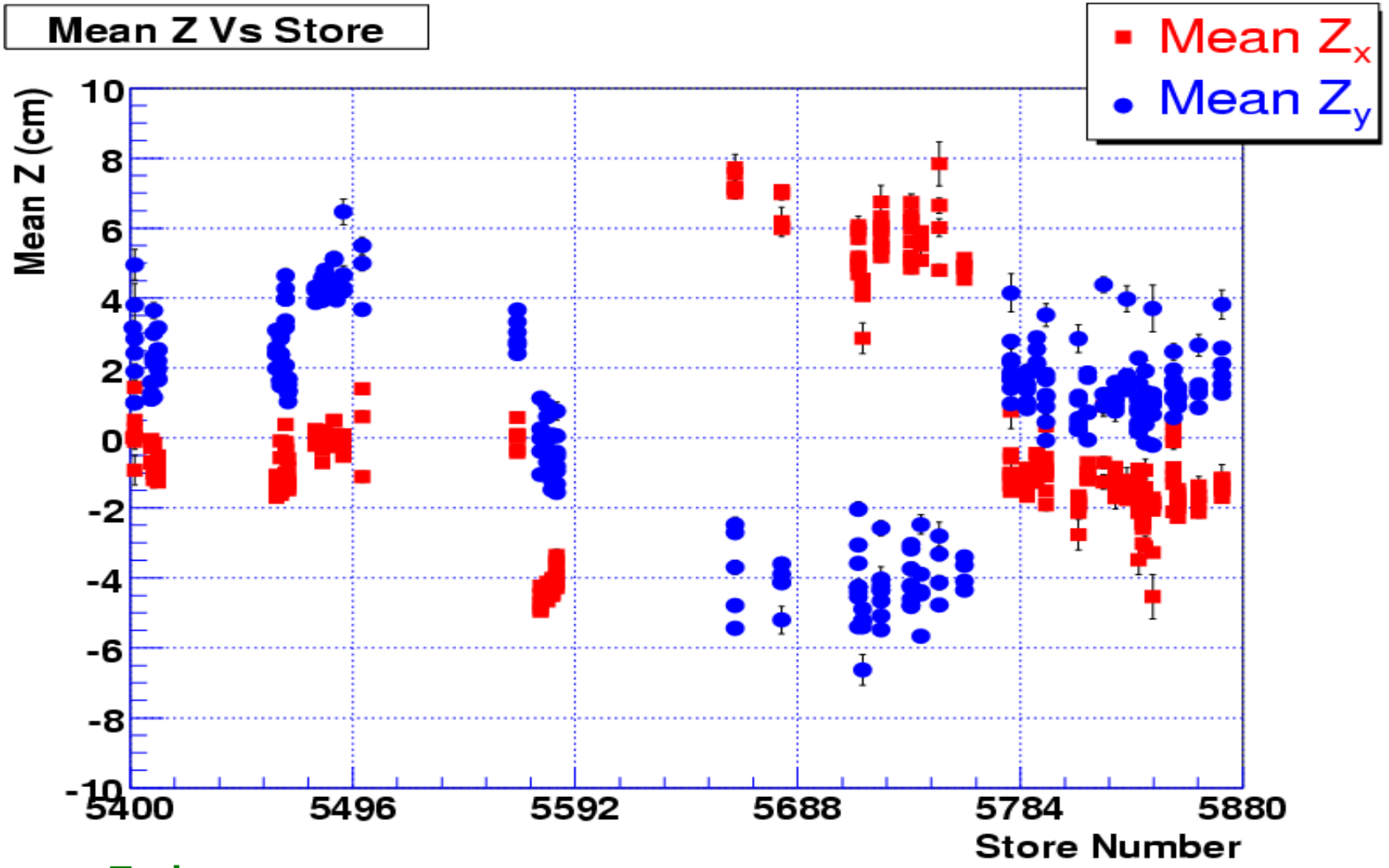
b^* vs. recent stores



Early
May'07

End
Jan'08

Z_i vs. recent stores



Early May'07

End Jan'08

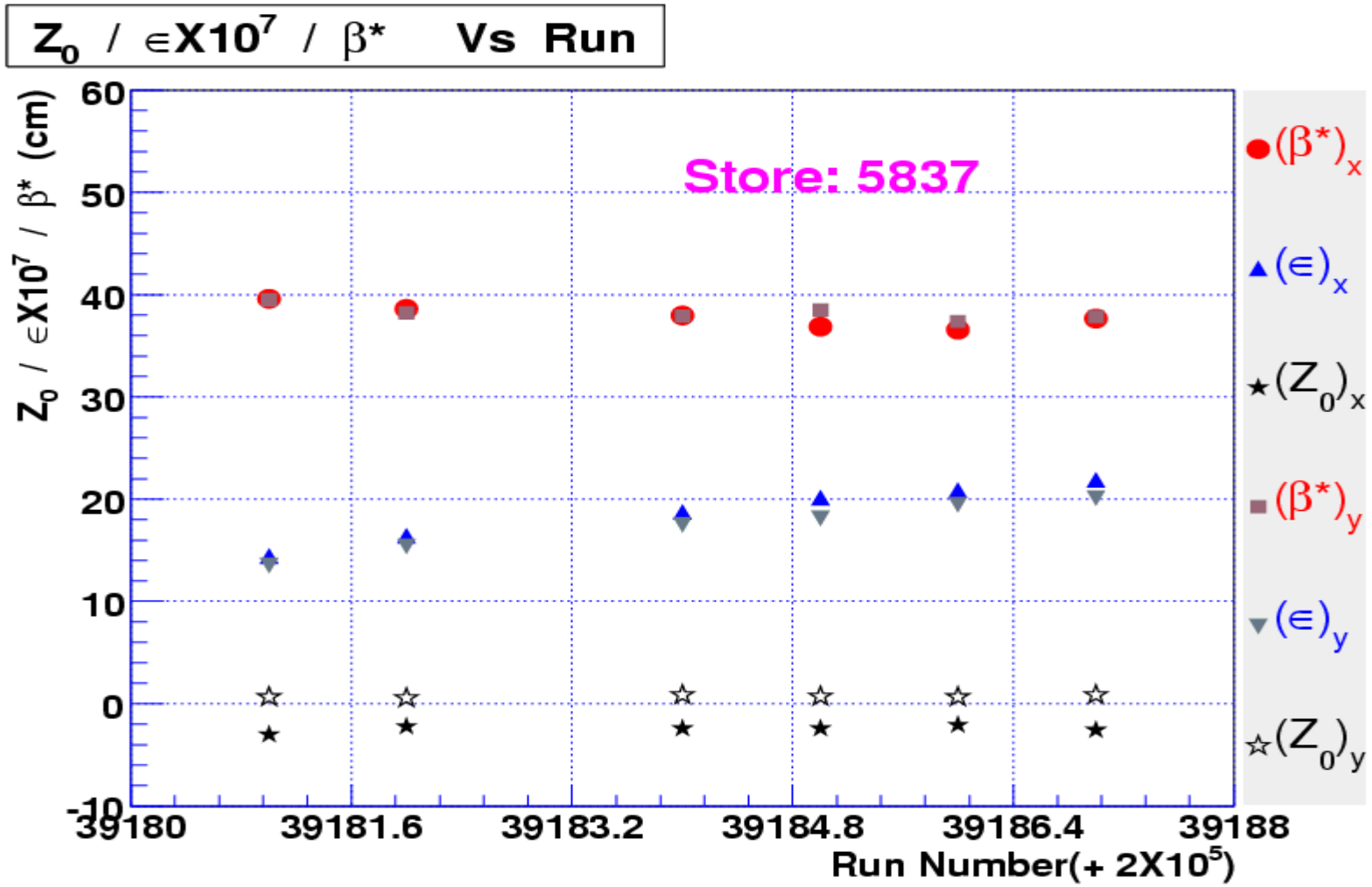
from last action item

✓ **After dipole change to the machine, to follow up on the "emittance measurement" action item as outlined in page 8 of http://www-bd.fnal.gov/SDA_Viewer/VaiaLuminosity/action_12052007.pdf**

✓ **Store 5837 of January 10, 2008 was decided for the check.**

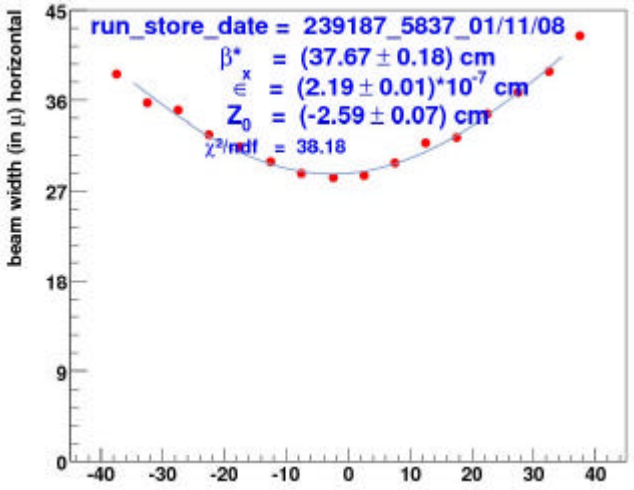
Store 5837

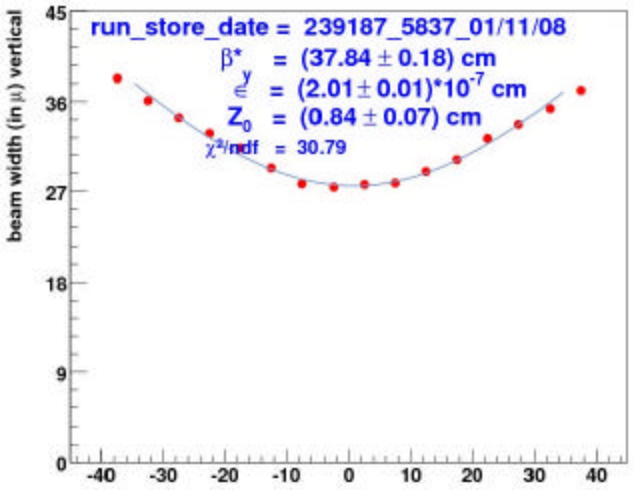
Jan 10, 08

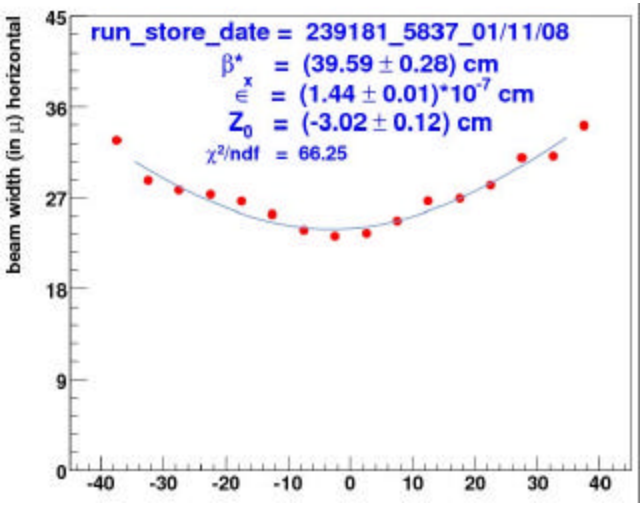


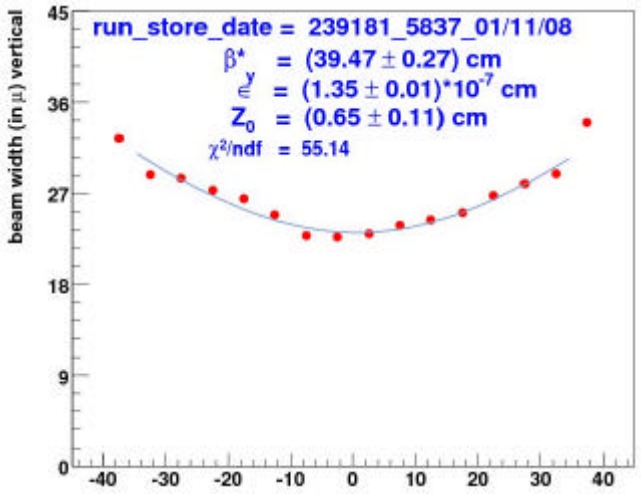
Store 5837

Jan 10, 08

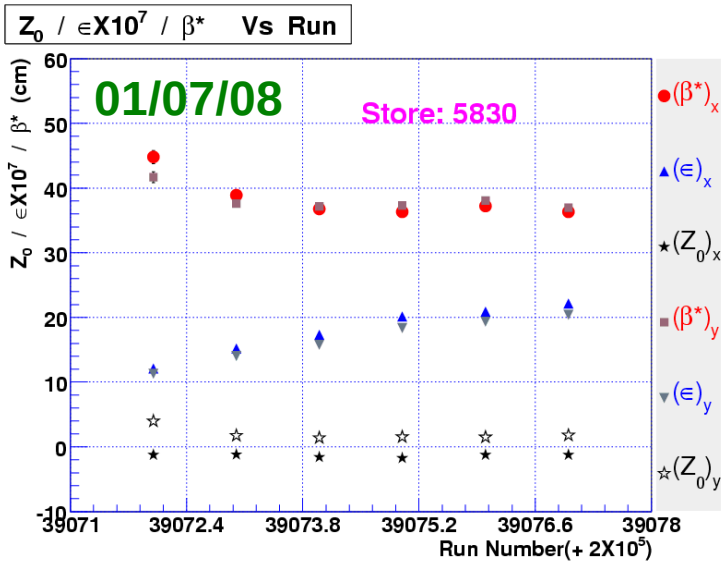


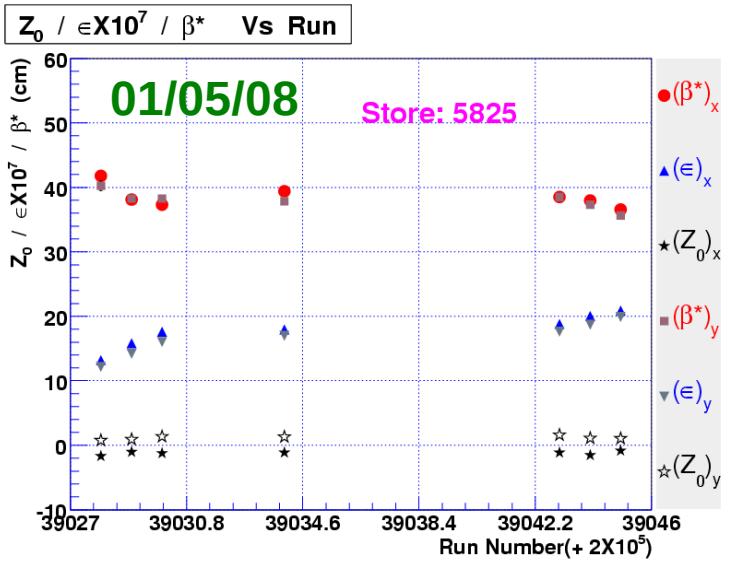


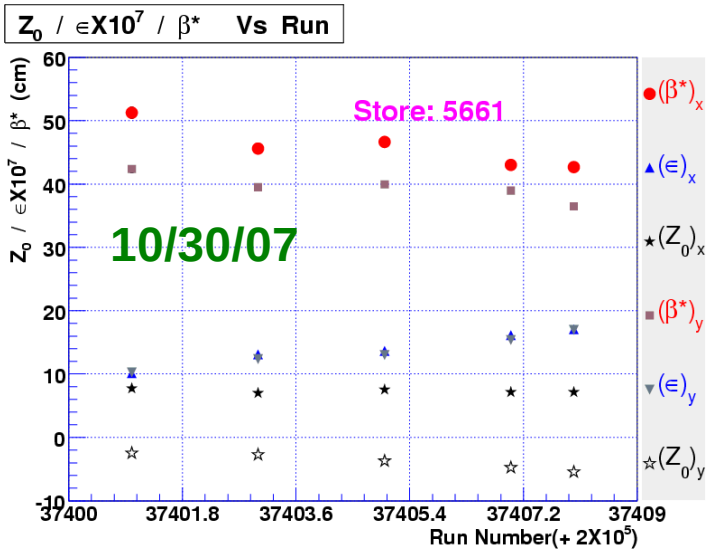


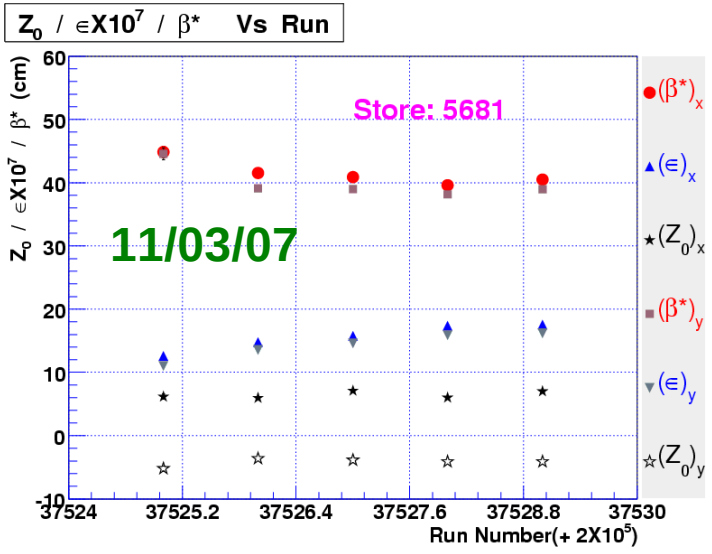


Before 5837

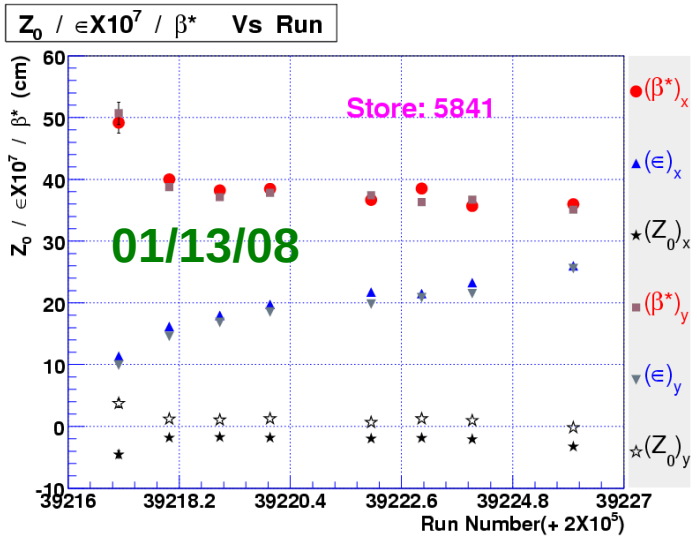

Z_0 / ϵX10^7 / β^* Vs Run
01/07/08
Store: 5830
Z_0 / ϵX10^7 / β^* (cm)
Run Number(+ 2X10^5)
$(\beta^*)_x$
$(\epsilon)_x$
$(Z_0)_x$
$(\beta^*)_y$
$(\epsilon)_y$
$(Z_0)_y$

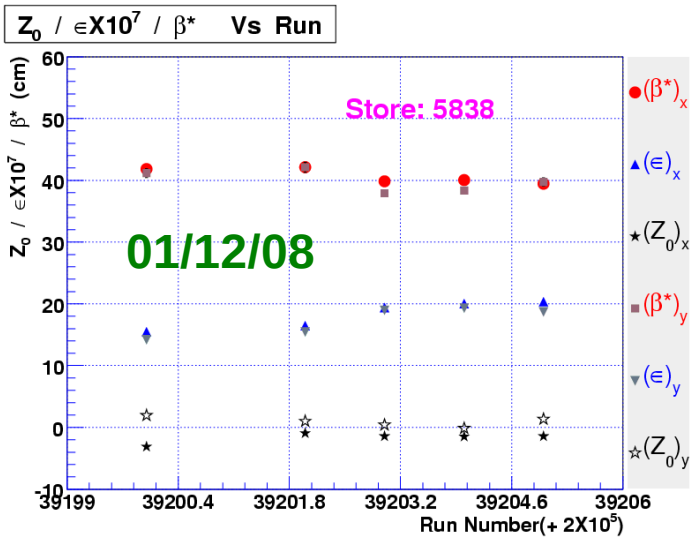

Z_0 / ϵX10^7 / β^* Vs Run
01/05/08
Store: 5825
Z_0 / ϵX10^7 / β^* (cm)
Run Number(+ 2X10^5)
$(\beta^*)_x$
$(\epsilon)_x$
$(Z_0)_x$
$(\beta^*)_y$
$(\epsilon)_y$
$(Z_0)_y$

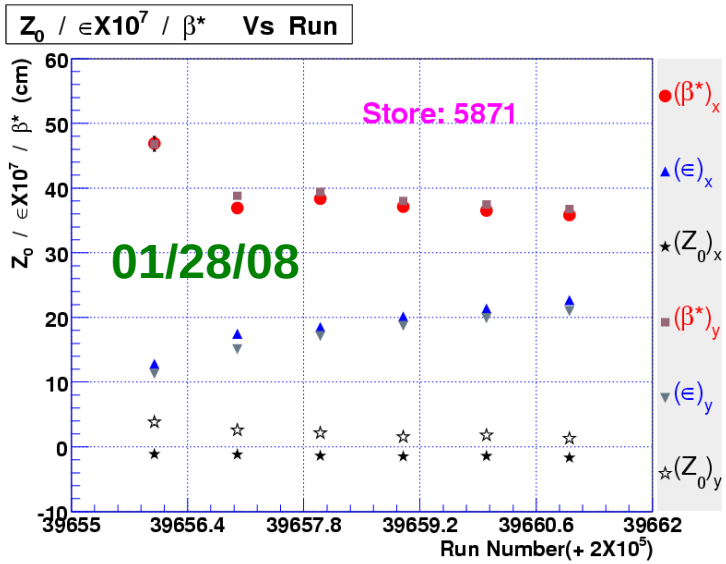

Z_0 / ϵX10^7 / β^* Vs Run
10/30/07
Store: 5661
Z_0 / ϵX10^7 / β^* (cm)
Run Number(+ 2X10^5)
$(\beta^*)_x$
$(\epsilon)_x$
$(Z_0)_x$
$(\beta^*)_y$
$(\epsilon)_y$
$(Z_0)_y$

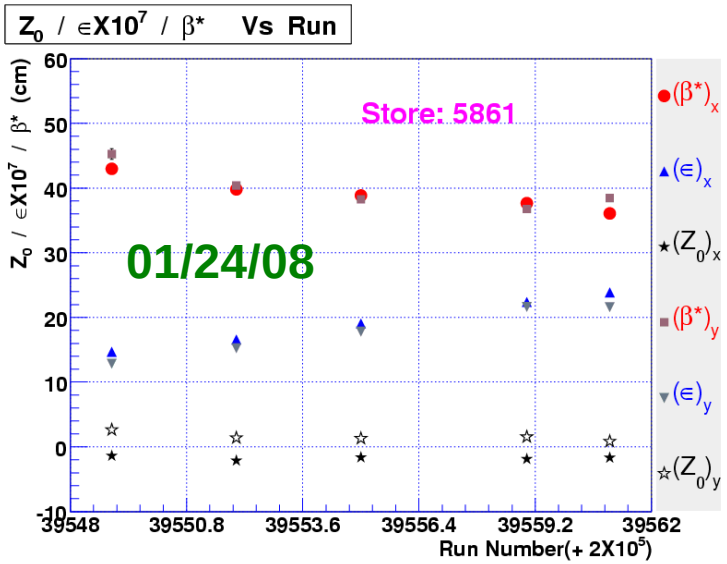

Z_0 / ϵX10^7 / β^* Vs Run
11/03/07
Store: 5681
Z_0 / ϵX10^7 / β^* (cm)
Run Number(+ 2X10^5)
$(\beta^*)_x$
$(\epsilon)_x$
$(Z_0)_x$
$(\beta^*)_y$
$(\epsilon)_y$
$(Z_0)_y$

After 5837


Z0 / ∈X10^7 / β* Vs Run
Store: 5841
01/13/08
Z0 / ∈X10^7 / β* (cm)
Run Number(+ 2X10^5)
(β*)x
(∈)x
(Z0)x
(β*)y
(∈)y
(Z0)y


Z0 / ∈X10^7 / β* Vs Run
Store: 5838
01/12/08
Z0 / ∈X10^7 / β* (cm)
Run Number(+ 2X10^5)
(β*)x
(∈)x
(Z0)x
(β*)y
(∈)y
(Z0)y


Z0 / ∈X10^7 / β* Vs Run
Store: 5871
01/28/08
Z0 / ∈X10^7 / β* (cm)
Run Number(+ 2X10^5)
(β*)x
(∈)x
(Z0)x
(β*)y
(∈)y
(Z0)y

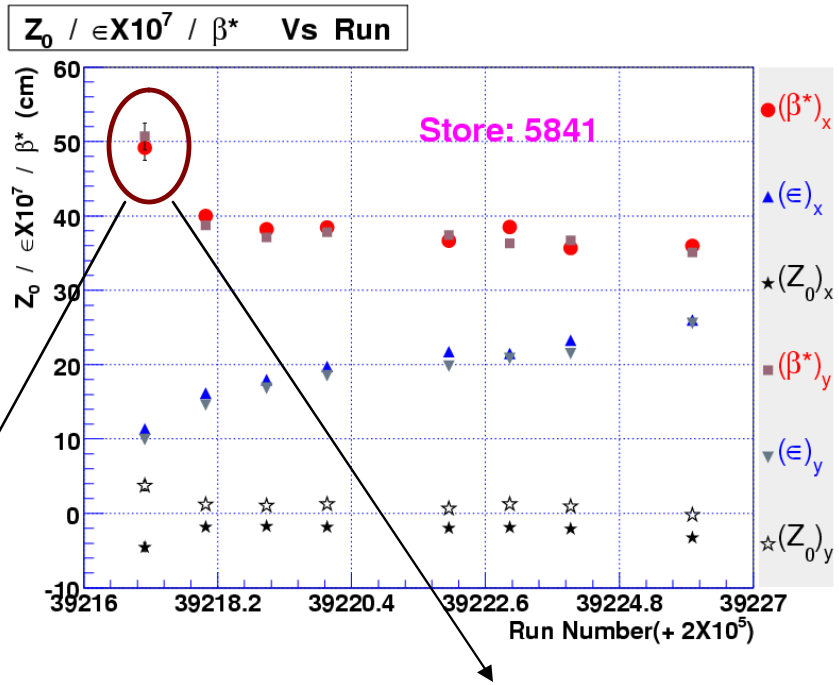

Z0 / ∈X10^7 / β* Vs Run
Store: 5861
01/24/08
Z0 / ∈X10^7 / β* (cm)
Run Number(+ 2X10^5)
(β*)x
(∈)x
(Z0)x
(β*)y
(∈)y
(Z0)y

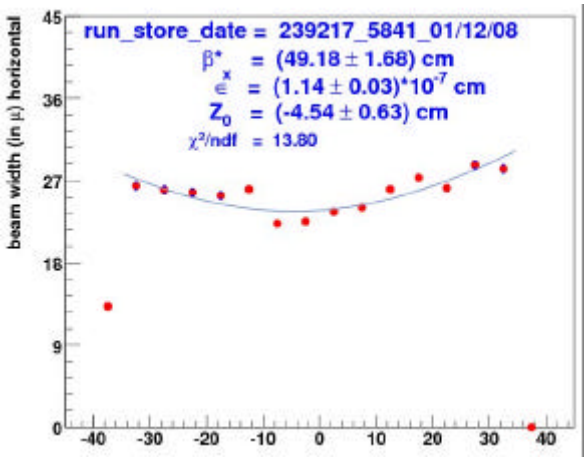
Summary

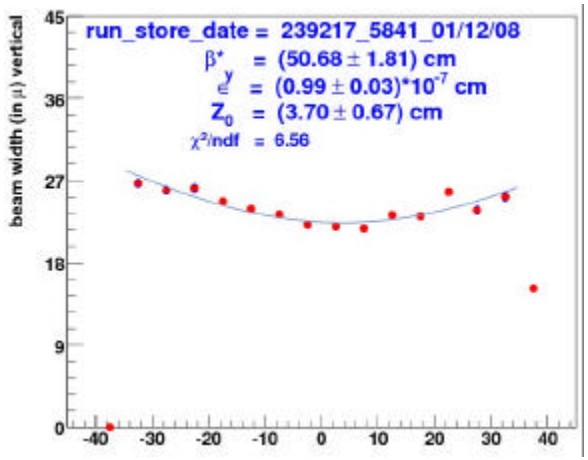
- Measurement shows that β^*_x and β^*_y not changed from last reported measurement.
- Mean Z_0 and beam position is again shifted towards 0 as it was before shutdown.
- The average value of β^*_x and β^*_y is ~40cm with some fluctuations.
- Updated results with many more store are available at:

http://www-clued0.fnal.gov/~avdhesh/Beam_main.html

Store 5841


Z_0 / ϵX10^7 / β^* Vs Run
Store: 5841
Z_0 / ϵX10^7 / β^* (cm)
Run Number(+ 2X10^5)
$(\beta^*)_x$
$(\epsilon)_x$
$(Z_0)_x$
$(\beta^*)_y$
$(\epsilon)_y$
$(Z_0)_y$


run_store_date = 239217_5841_01/12/08
β^*_x = (49.18 ± 1.68) cm
ϵ_x = (1.14 ± 0.03)*10^{-7} cm
Z_0 = (-4.54 ± 0.63) cm
χ^2/ndf = 13.80
beam width (in μ) horizontal


run_store_date = 239217_5841_01/12/08
β^*_y = (50.68 ± 1.81) cm
ϵ_y = (0.99 ± 0.03)*10^{-7} cm
Z_0 = (3.70 ± 0.67) cm
χ^2/ndf = 6.56
beam width (in μ) vertical